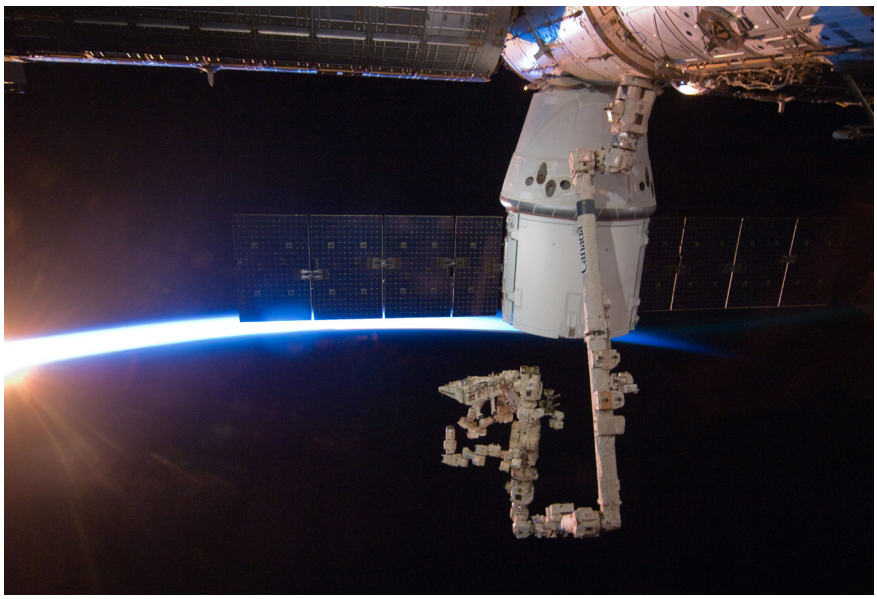
NASA's Return On Investment Report

Issue 7 **June 2012**

This bi-monthly newsletter of accomplishments, progress, and happenings in NASA's commercial crew and cargo programs is distributed by the Commercial Spaceflight Development Division at NASA Headquarters.

SpaceX Successfully Completes COTS Demonstration Mission

On May 31, Space Exploration Technologies (SpaceX) completed its final Commercial Orbital Transportation Services (COTS) demonstration mission, clearing SpaceX to begin commercial resupply service missions to the International Space Station later this year. This mission was a huge step toward allowing regular cargo carrying missions to the ISS by the U.S. private sector.

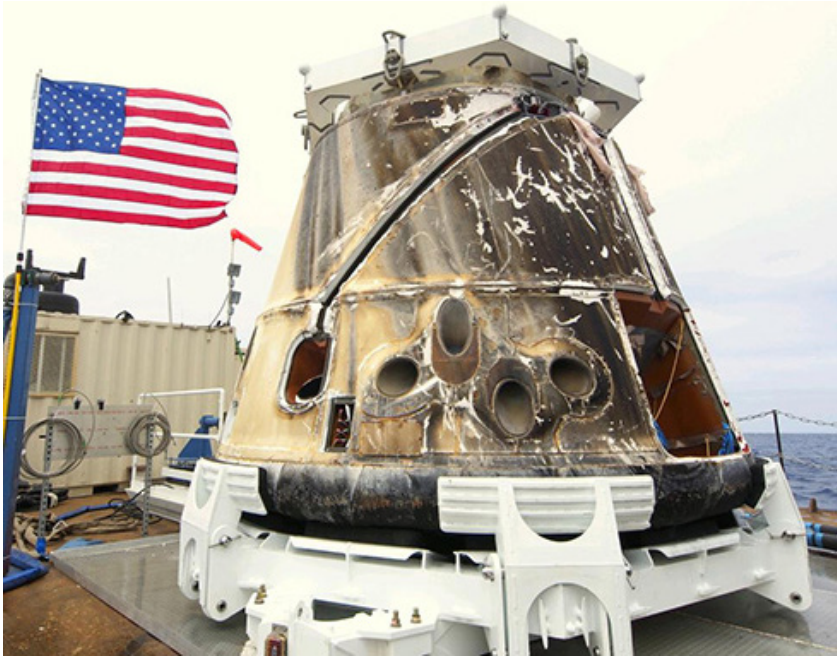


The SpaceX Dragon commercial craft is berthed to the Earth-facing side of the International Space Station's Harmony node. Photo credit: NASA

SpaceX conducted the historic flight within 11 months of the final space shuttle flight, minimizing the gap in the U.S. space station cargo transportation capability. Additionally, this flight represents the first time a U.S. spacecraft has autonomously berthed to the orbiting outpost. "This was an incredibly challenging mission from a technical standpoint," said Phil McAlister, NASA's director of commercial spaceflight. "To say that I am pleasantly surprised that the mission went so smoothly is an understatement."

This demonstration mission accomplished all the objectives of what was originally planned to be two separate test flights. After the launch was successfully aborted on May 19 because of a faulty engine valve, SpaceX's Falcon 9 rocket lifted off at 3:44 a.m. EDT on May 22. The next couple of days were spent testing the Dragon spacecraft's ability to perform specific tasks, including free drift and abort maneuvers, while maintaining a distance of about 1.5 miles below the space station. The Dragon's navigation and communications systems also were verified, including the ability to accept commands directly from the station's crew.

Given the success of these demonstrations, NASA authorized Dragon to approach the space station on May 25. After closing to about 32 feet, Expedition 31 flight engineer Don Pettit of NASA used the space station's robotic arm to capture Dragon and berth it to the station's Node 2. The station crew opened the hatch on May 26 and unloaded new supplies and packed return cargo over the four days Dragon remained attached



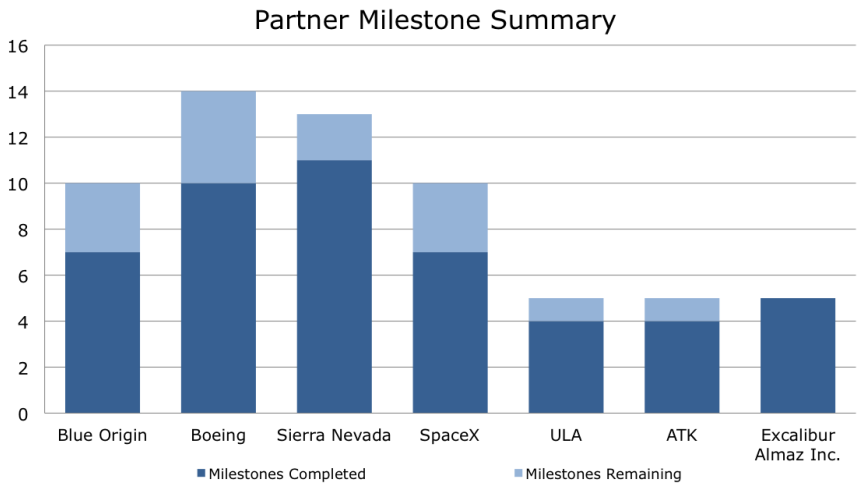
SpaceX's Dragon capsule sits on a barge after being retrieved from the Pacific Ocean after splashdown. Photo credit: SpaceX

to the orbital laboratory. The crew closed Dragon's hatch on May 30 and released the capsule early on May 31. It splashed down off the coast of California, and SpaceX personnel immediately began post-landing operations. The program has confirmed that SpaceX successfully completed all COTS demonstration mission objectives.

As originally envisioned, the COTS project has two major goals: 1) demonstrate crew and cargo transportation services that NASA could potentially purchase in the future and 2) enable the U.S. to become more competitive in the global launch marketplace. Successful completion of this demonstration mission, along with SpaceX's recent announcements of commercial launch agreements with other customers, indicate both goals are being accomplished.

This partnership between NASA and SpaceX demonstrates the ability of NASA and commercial partner teams to develop complicated space systems that help NASA meet its needs while strengthening U.S. industrial capability and competitiveness.

Partners Continue Meeting Commercial Crew Milestones



A summary schedule showing all completed and planned CCDev2 milestones can be found at: http://www.nasa.gov/exploration/commercial/

Boeing's CST-100 crew capsule floats to a landing above the Delmar Dry Lake Bed near Alamo, Nev, on May 2. Photo credit: Boeing

NASA's commercial crew partners continue to achieve exciting milestones as the Commercial Crew Development Round 2 (CCDev2) Space Act Agreements enter their home stretch. Since the agreements were awarded in April 2011, the partners have achieved 48 of the 62 planned test, demonstration, and technical review milestone events. With the maturation of spacecraft and launch vehicle designs being accomplished under CCDev2, NASA's Commercial Crew Program is well positioned to move into the integrated capability design and testing phase. Awards for new Space Act Agreements are expected in July/August 2012.

An example of a recent significant CCDev2 accomplishment is the Boeing Company's CST-100 parachute drop test. The company successfully completed the second of two tests that validated its parachute and latest landing airbag systems designs. During the test, a helicopter lifted the CST-100 crew capsule to 9,400 feet above the desert floor in Nevada, about a hundred miles north of Las Vegas. After the capsule

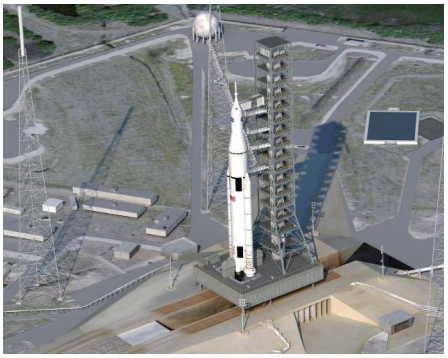
Pusher Escape Flight Test Vehicle shipment. Photo credit: Blue Origin

was released, drogue parachutes immediately deployed to orient the capsule, followed by the three main parachutes. Airbags on the bottom of the capsule then inflated, and the capsule settled to a soft landing. This demonstrated how the CST-100 will be able to return crews from the International Space Station safely with land-based landings, simplifying crew recovery relative to water-based landings.

Another example of a recent CCDev2 milestone is Blue Origin's "pusher" escape system test vehicle, which has now been assembled and shipped to the company's test range near Van Horn, Texas. This is a significant milestone in preparation for Blue Origin's pad escape flight test planned for later this summer. The pusher escape system protects crew in the event of a catastrophic failure of the launch vehicle, enabling the crew vehicle to carry the crew to safety. The upcoming test campaign will validate the system's rocket motor and thrust vector control.

Commercial Space Transportation Enables Deep Space Exploration

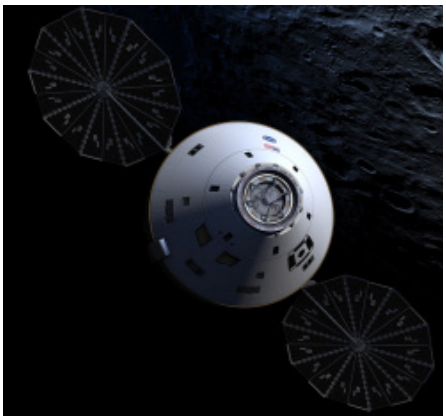
NASA's commercial crew and cargo transportation programs will restore America's access to low Earth orbit and ensure the agency's ability to resupply the International Space Station and rotate its U.S. crews. In addition to this very tangible benefit to NASA's immediate human spaceflight efforts, the commercial space programs are also enabling NASA's longer term deep space human exploration goals. Transitioning low Earth orbit access safely and affordably to commercial industry frees up budget, personnel and facilities that NASA now can apply to developing the Orion Multi-Purpose Crew Vehicle, the heavy lift Space Launch System (SLS), and other spacecraft and ground support infrastructure needed to send humans beyond Earth's orbit.



Concept image of NASA's Space Launch System.

The space shuttle and old Constellation program's Ares I and Orion were both overdesigned for simple taxi service for transporting NASA astronauts to and from the International Space Station. In contrast, the Commercial Crew Program is facilitating the development of systems specifically designed for transporting people to and from low Earth orbit and the International Space Station. This allows the crew transportation systems to be operated more efficiently, saving money and personnel that can be used for other missions.

NASA already is making steady progress in the next great chapter of deep space exploration. Orion is on track for a high altitude orbital test flight in 2014, and SLS is moving swiftly toward a test flight in 2017 that will include a fly-by of the moon. In addition to making use of the resources now available for exploration systems development, NASA is using existing hardware and capabilities to the extent feasible to accelerate progress on the spacecraft and launch vehicles that ultimately will have greater capability than ever before to carry humans and cargo into deep space.



Concept image of NASA's Orion Multi-Purpose Crew Vehicle.

Through commercial space transportation, together with the capabilities to explore deep space that Orion and the SLS will provide, NASA has a robust, complementary U.S. human spaceflight program.

For more information on any of the articles in this report, contact Joshua Buck or Trent Perrotto in NASA's Public Affairs Office at 202-358-1100. To review NASA's other commercial space accomplishments, visit: http://www.nasa.gov/exploration/commercial/